



Cpernicus

C4ISR FOR THE 21ST CENTURY

In 1990 the Naval Services revolutionized their Command, Control, Communications, Computers, and Intelligence architecture by shifting from a technology centric to a warfighter centric focus. To capture the magnitude of this change the Naval Services named this new architecture Copernicus. Nicholas Copernicus was the Polish astronomer who revolutionized science in the early 1500s by discrediting long held beliefs with his heliocentric theory. He proposed that the earth and neighboring planets revolved around a stationary sun. The Copernicus architecture is dedicated to Nicholas Copernicus for his extraordinary insight.



Copernicus

C4ISR For the 21st Century

Foreword

All over the world, American companies are “forward deployed.” American business invests in overseas presence because “being there” is clearly the best way to do business. We agree. Sailors and Marines are continuously forward deployed aboard combat-ready amphibious assault ships and aircraft carrier battle groups in the Mediterranean Sea, Persian Gulf and Far East. This “forward presence” is vital, but not always as visible to Americans as it is to the rest of the world. Some argue that forward presence is no longer necessary. They argue that forces reacting from the United States are enough to maintain international stability and that America can no longer afford near continuous forward presence. We would argue just the opposite. Forward deployed U.S. forces, primarily the Navy-Marine Corps expeditionary team, are vital to regional stability and keeping small crises from escalating. To those who argue that the United States can no longer afford this degree of vigilance, we say the United States can’t afford not to! The Cold War was an anomaly. We no longer live in a bipolar world whose nuclear shadow suppresses nationalism and ethnic tensions. “Brushfires,” whether the result of long-standing ethnic tensions or resurgent nationalism will continue. We have, in some respects, reverted to the world our forefathers knew - a world in disorder. Somalia, Bosnia, Liberia, Haiti, Rwanda, Iraq and the Taiwan Straits are the types of continuing crises we now face. Some might call this period an era of chaos. The United States and the world cannot afford to allow any crisis to escalate and threaten the world’s vital interests.

Today’s world demands a new approach. Options must include selective and committed engagement, unencumbered global operations and prompt crisis resolution. There is no better way to execute these options than with forward presence of the Navy-Marine Corps team.

There are four basic tenets to international security in today’s world: prevention, deterrence, crisis resolution and war termination. Presence is the key to prevention and the psychological impact of Naval Expeditionary Forces is undeniable. This lets our friends know of our continuing interest and lets potential foes know that we are there to check any move. Yet we know that presence does not prevent every crisis. Some adversaries will strike no matter what the odds. When crises reach this threshold, Naval Expeditionary Forces can go quickly on the offensive to bring swift resolution. Friends and potential enemies recognize the defend or destroy capability of Naval Expeditionary Forces.

Just as the “visible fist” of naval forces is central to forward presence, Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR), is the “invisible fist” and key enabler to successful naval operations conducted Forward...From The Sea. Building on the foundation of Joint Vision 2010, the Navy-Marine Corps team refined its shared *Copernicus* vision for future C4ISR. Information Superiority, enhanced situational awareness and speed of command, embodied in our Naval *Copernicus* Vision allows our forward deployed forces to quickly mass firepower to extend their combat radius without waiting for the arrival of U.S. based forces. *Copernicus* leverages C4ISR capabilities to make the forward deployed Navy-Marine Corps team the right force, tailor-made for the uncertain and sometimes fiery times of the 21st Century.



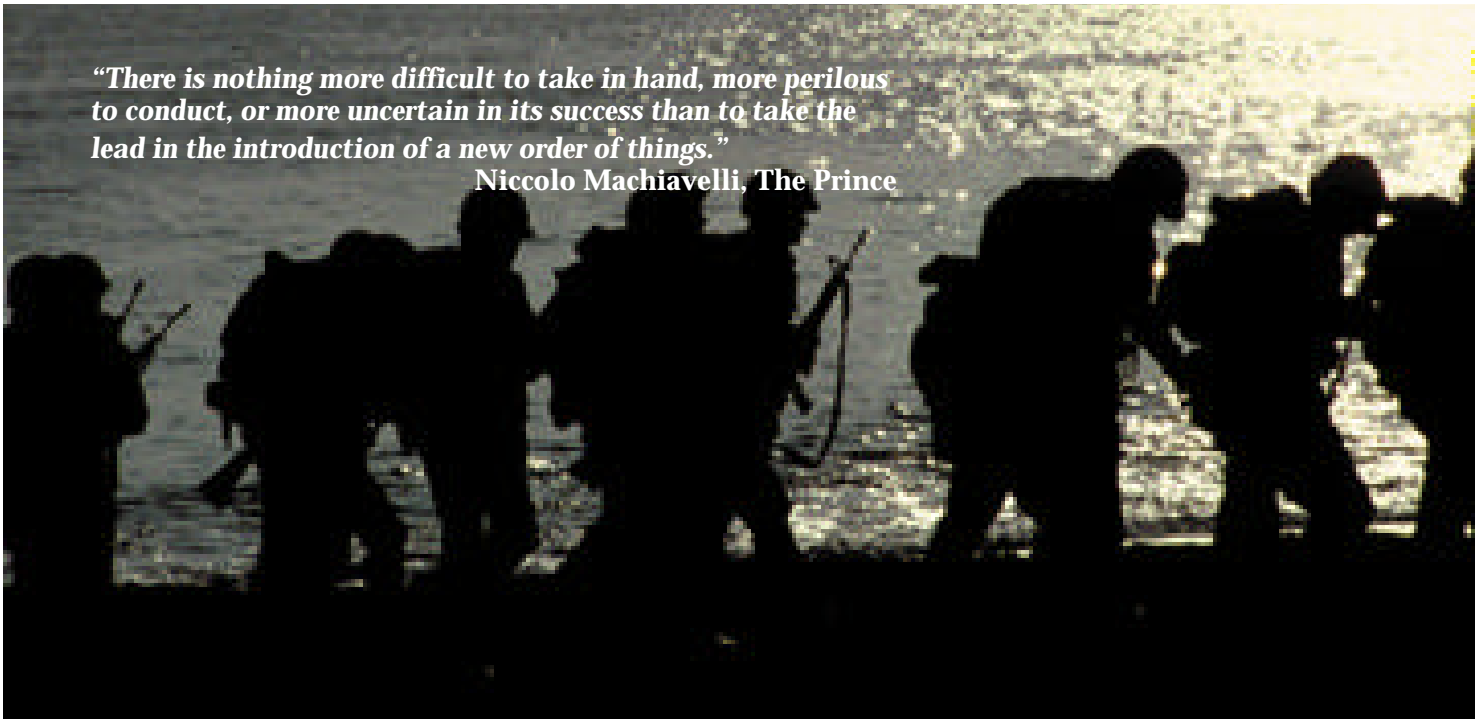
A black and white handwritten signature of General Charles C. Krulak.

General Charles C. Krulak, USMC
Commandant of the Marine Corps



A black and white handwritten signature of Admiral Jay L. Johnson.

Admiral Jay L. Johnson, USN
Chief of Naval Operations

A black and white photograph showing the silhouettes of several soldiers in a field. They are wearing helmets and carrying equipment, with some holding rifles. The background is a bright, hazy landscape.

“There is nothing more difficult to take in hand, more perilous to conduct, or more uncertain in its success than to take the lead in the introduction of a new order of things.”

Niccolo Machiavelli, *The Prince*

INTRODUCTION

Copernicus explores the impact and harnesses the potential of technology and information in response to a dynamic, complex national security environment. *Copernicus* considers information and information technology as fundamentally new approaches to viewing and responding to the emerging international security environment and not simply as a force multiplier to be grafted onto the existing structure.

The Joint Vision *C4I For the Warrior (C4IFTW)* challenged the Services to develop “a global C4I system that satisfies the total information requirements of warriors when they fight as a team with a common mission.” For the Navy and Marine Corps, the challenge of C4IFTW takes on added significance as the source for their shared Naval Vision for the future, *Copernicus*.

This common vision enables the Navy and Marine Corps to adapt, evolve and fully integrate their Command and Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) capabilities and resources to conduct successful Joint Naval Expeditionary Force operations in the 21st Century.

Navy and Marine Corps warriors fighting Forward...*From The Sea* will have the capability to achieve dominant maneuver, precision engagement, full dimensional protection and focused logistics in any clime and place.

The first part of *Copernicus* explores the impact of the Information Era on the emerging strategic environment in which Naval warfighters must operate. It examines the sources of conflict and frames the National Security and Military Strategies against the new conceptual template, *Joint Vision 2010*. It then presents the Naval warfighting strategy with its focus on power projection in the littorals. The first half of *Copernicus* concludes with a discussion of the principles and objectives of the Naval C4ISR vision for the 21st Century.

The second part of *Copernicus* discusses the Naval C4ISR operational framework, the possibilities created by Information Technology and the emerging concept of network centric warfare. The key enablers of network centric warfare are: C4ISR, speed of command, co-evolution of technology, organization and doctrine.

New operational concepts, a dynamic international environment and fiscal constraints place challenging and unique demands on the Navy-Marine Corps team. *Copernicus* leverages C4ISR capabilities to enable Naval forces of the 21st Century to meet these challenges.

STRATEGIC ENVIRONMENT

"Chaos is the name for any order that produces confusion in our minds."

George Santayana

A New Strategic Landscape

Today's world is experiencing an enormous shift in traditional sources of power. This shift is uprooting the established order, leaving cultural fault lines and creating economic stratification between those who are successfully adapting to this transition and those who are not. This change is creating a division of the international order based on economic modes of production: information era states which mine information and technology bases to generate wealth; industrial era states which depend on industrial production as the basis of their economy; and agrarian states which rely mostly on land and natural resources as their chief economic impetus. While the roots of this power shift are primarily technological and economic, the shock waves created by this change are rippling through all layers of society and leaving the potential for conflict in its wake. The fulcrum of this change is the phenomenal growth in Information Technology with the immediate access to information made possible by computer technology and global telecommunication networks.

World Disorder

The world is characterized by a widening breakdown of order and vastly accelerating information technologies. Shock waves from the information and telecommunication explosion ripple through every corner of the globe, affecting traditional societies and potentially undermining the power and influence of the traditional international actor - the nation state. Competing sources of power at subnational and transnational levels fill voids created by these collapsing economic, political and security structures. The nation state is caught between these forces. Results of these changes and ensuing power struggles manifest themselves in widespread ethnic and religious conflicts, nation state and alliance collapses, refugee explosions, global terrorism and an

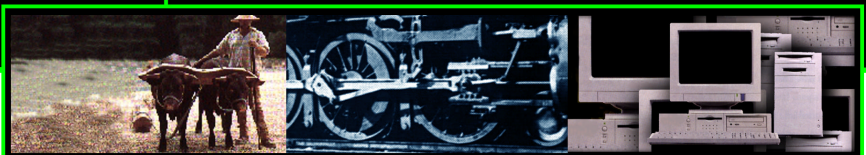
increase in transnational criminal activity. The more static and predictable bipolar world of the late Industrial Era is being replaced by a more dynamic and unpredictable multipolar world of the early Information Era.

Sources of Conflict

Traditional conflicts between nation-states over natural resources, land and regional domination will most likely continue into the 21st Century. Regional powers that acquire weapons of mass destruction will become even more powerful. During this period of structural adjustment, central governments will lose much of their traditional monopoly on economic, political and military power. Moreover, the growth of, and easy access to information, creates a low entry cost into information warfare for belligerents at all levels of the threat spectrum. Sources of conflict springing from global change create a threat spectrum that runs the gamut from humanitarian crises and terrorism, to regional conflict and strategic information warfare. It is the entire range of these conflicts, not any single type, that is determining the future of warfare.

FUTURE WAR

POTENTIAL THREATS	SUBNATIONAL	NATIONAL	TRANSNATIONAL
CONFLICT OBJECTIVE	INFLUENCE	INDUSTRIAL INFRASTRUCTURE	INFORMATION TECHNOLOGY ECONOMIC DOMINANCE
SOURCE OF CONFLICT	TERRITORIAL CLAIMS	EXPANSION	ECONOMIC AND CULTURAL
TYPE OF CONFLICT	LOCAL TERRORISM	REGIONAL WAR TERRORISM	CYBERWAR TERRORISM
INSTRUMENTS OF CONFLICT	SMALL ARMS INFO/TERRORISM	WEAPONS	ECONOMIC INFORMATION
CONFLICT DOCTRINE	ASYMMETRIC	SYMMETRIC OR ASYMMETRIC	INFORMATION SYMMETRIC OR ASYMMETRIC



WARFIGHTING STRATEGIES

“Information superiority and advances in technology will enable us to achieve the desired effects through the tailored application of joint combat power.”

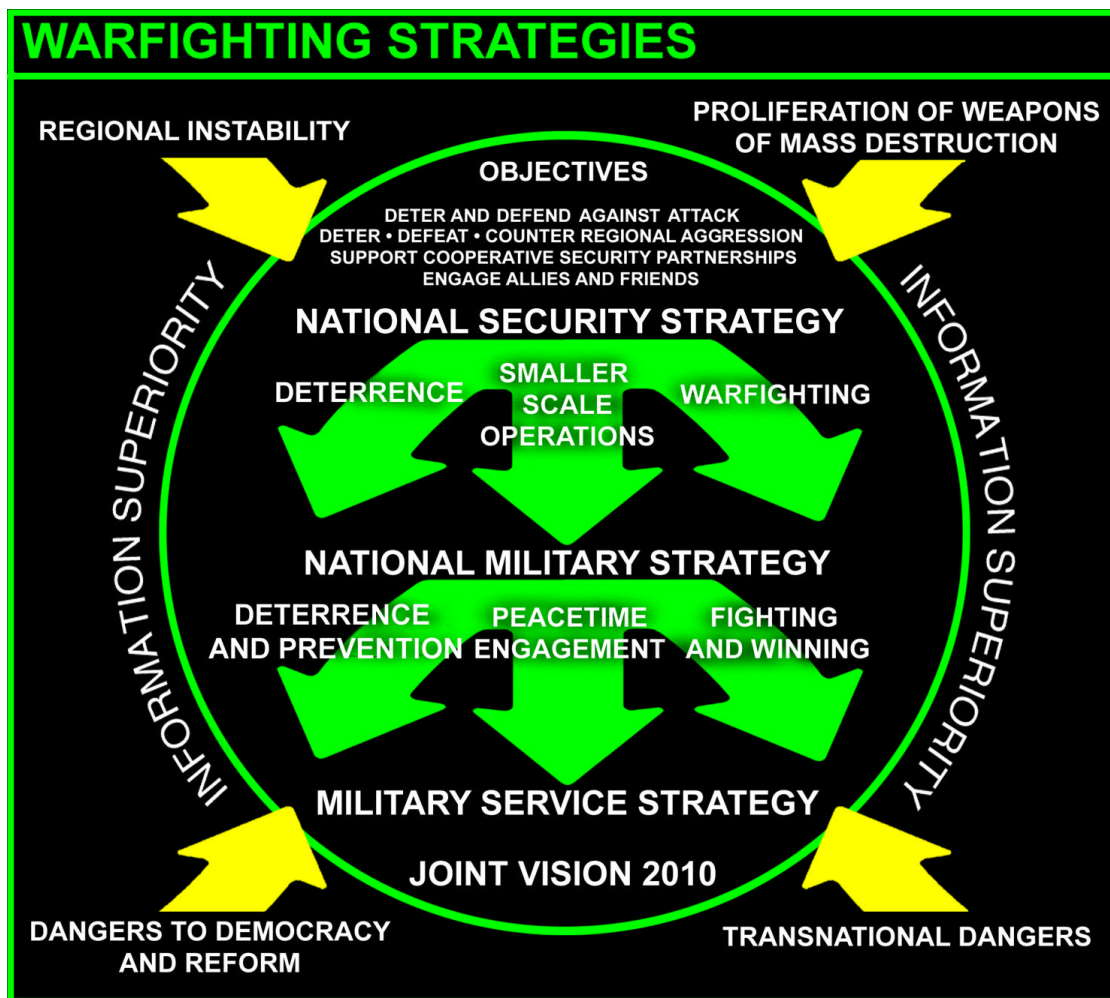
Joint Vision 2010

National Security Strategy

The *National Security Strategy* of engagement and enlargement responds to an emerging international environment punctuated by regional instability, transnational dangers, threats to democracy and the proliferation of weapons of mass destruction. In addition to its fundamental objective for defense of the United States, it focuses on defeating regional aggression, developing cooperative security partnerships and enjoining allies and friends. These objectives are accomplished through a three-pronged strategy that emphasizes deterrence, smaller scale operations, and warfighting.

National Military Strategy

In response to the *National Security Strategy*, the Joint Chiefs established the *National Military Strategy*. The primary objectives of this strategy are: to promote stability through regional cooperation and constructive interaction and to thwart aggression through credible deterrence and robust warfighting capabilities. The strategy calls for military capabilities ranging from peacetime engagement, deterrence and conflict prevention, to fighting and winning the nation's wars. To achieve these objectives, the Joint Chiefs of Staff published its unified direction: *Joint Vision 2010*



Joint Vision 2010

Joint Vision 2010 is the road map for all the Services to integrate new concepts, leverage technological advances and channel their vitality and innovation toward successful Joint warfighting. It focuses on four operational concepts:

Dominant Maneuver

Dominant maneuver, achieved through positional advantage and speed, provides the opportunity to attack enemy centers of gravity and compels the adversary to react from a position of disadvantage. Dominant maneuver will require forces adept at conducting sustained and synchronized operations from dispersed locations. The organizational concept of dominant maneuver will provide more agile Joint operations, combining air, land and maritime forces more effectively to deliver decisive combat power.

Precision Engagement

The United States enjoys advantages in sensing, delivery accuracy, low observable technologies and precision engagement. This enables our forces to locate the objective, provide responsive command and control, generate the desired effect, assess our level of success and retain the flexibility to reengage with precision when required. Precision engagement capabilities provide Joint Force Commanders with a wide array of responsive, accurate and flexible options.

Full Dimensional Protection

Capitalizing on information superiority, full-dimensional protection will shield our forces from the same technologies our forces are exploiting. Active measures will include battlespace control operations, integrated, in-depth air and missile defense and combat identification systems. These measures will provide multidimensional awareness and exploit Service-unique capabilities to detect, identify, locate and track enemy forces and deny their attacks on our forces.

Focused Logistics

Focused logistics provide rapid crisis response using technologies to transition from rigid vertical organizations of the past. Focused logistics will provide the ability to track and shift assets even when already enroute, delivering tailored logistics packages and sustainment to all levels of operation. Focused logistics will be fully adaptive to the needs of our increasingly dispersed and mobile forces, providing needed capabilities in hours or days versus weeks. Focused logistics will enable the more mobile, versatile and lethal Joint Force of the future.





WORLD WIDE NAVAL OPERATIONS

Naval Warfighting Strategy: Forward...From the Sea (FFTS)

The current *National Security* and *National Military Strategies* validate the Department of the Navy's timely shift in strategic focus articulated in *Forward... From the Sea* and its predecessor, *From the Sea*. These white papers fundamentally shifted the operational focus of the Sea Services to littoral power projection. This focus requires the United States to maintain the capability to project power ashore. Operating from sea bases, these forces can engage swiftly and accomplish a wide range of missions. Projecting strength and influence among the world's littorals is uniquely available to Naval forces. Forward deployed Naval forces provide sea control, battlespace dominance, expeditionary power projection, military operations other than war and operational logistics and strategic sealift. This basic realignment in Naval warfighting priorities places unprecedented emphasis on littoral areas, introduces the concept of the Naval Expeditionary Force (NEF) and provides the foundation for Naval operational maneuver: Navy Operational Concept and Operational Maneuver From The Sea.

Navy Operational Concept (NOC)


NOC defines how Naval power gains maritime superiority and establishes battlespace dominance in the littoral. At the strategic level, maritime superiority includes gaining and maintaining control of sea lanes and ocean areas critical to the success of overall national strategy. At the operational level, maritime superiority establishes operational sea control of littoral areas. Operational sea control is the degree of control necessary to achieve the objectives of the joint or multinational campaign plan. NOC enables Naval operations in littoral waters supporting the Joint Force Commander's concept of operations and campaign objectives.

Naval forces focus on shaping and dominating the littoral battlespace ensuring maritime superiority for Naval operations and Joint Force deployments. Dominating the battlespace means gaining sufficient tactical and operational superiority over enemy forces for friendly forces to achieve their objectives. It encompasses maritime, air and information superiority, force protection and delivering Naval firepower to disrupt and degrade the enemy's ability to effectively employ firepower and maneuver in battle.

Operational Maneuver From The Sea (OMFTS)

The heart of OMFTS is maneuvering operational Naval forces to exploit the enemy's critical vulnerabilities in order to deal a decisive blow. What distinguishes OMFTS from other operational maneuver is extensive use of the sea as a means of gaining advantage. The sea is an avenue for friendly movement that is simultaneously a barrier to the enemy and a means of avoiding disadvantageous engagements. OMFTS exploits the sea as a secure maneuver space and seeks to generate overwhelming tempo and momentum to which the enemy cannot respond. OMFTS focuses on exploiting enemy gaps and vulnerabilities to attack centers of gravity.

Historically, amphibious operations included a dangerous operational pause during the force buildup ashore before pressing on to operational objectives. OMFTS and NOC eliminate this pause through seamless and continuous maneuver of combat power from ship to objective. OMFTS requires enhanced Naval Expeditionary Force integration and places greater demands on C4ISR. OMFTS will combine doctrine with technological advances in mobility, fire support, communications and navigation to rapidly identify and exploit enemy weaknesses across the entire spectrum of conflict.



"The best way to predict the future is to create it"

Peter Drucker



C4ISR VISION AND IMPLEMENTATION

Joint Vision: C4I For The Warrior (C4IFTW)

C4I For The Warrior is the conceptual roadmap for achieving global Joint C4I interoperability that will allow any warfighter to perform any mission, any time, any place and is responsive, reliable, secure and affordable. C4IFTW portrays a C4ISR environment which maximizes the efficient and effective application of information throughout the Services. Its vision is aptly summarized in *Joint Publication 6.0, Doctrine for Command, Control, Communications and Computer (C4) Systems Support to Joint Operations*, the keystone document for C4 systems supporting Joint operations. The foundation for C4 is the continuous, uninterrupted flow and processing of information supporting warfighting. Warfighters must have C4 systems that are interoperable, flexible, responsive, mobile, disciplined, survivable and sustainable. "The fundamental objective of C4 systems is to get the critical and relevant information to the right place at the right time."

Naval Vision: Copernicus

Copernicus is the Naval C4ISR vision supporting Joint and Naval warfighting strategies. *Copernicus* enables the Navy-Marine Corps team to evolve, adapt and integrate their C4ISR capabilities to meet the demands of the new strategic environment, emerging operational concepts and evolving information technologies. It is the unifying vision

to ensure C4ISR systems respond to the warfighter, are fielded quickly, capitalize on technological advances and support warfighting concepts.

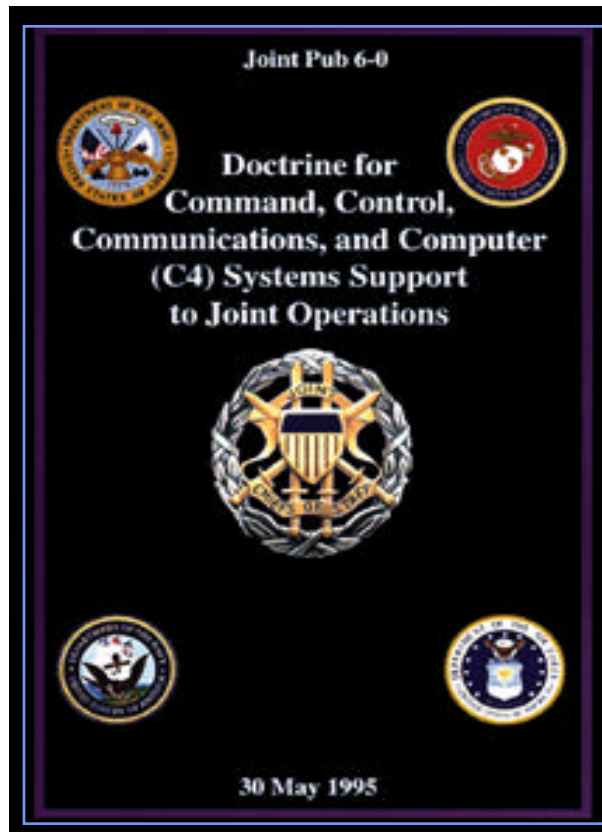
Copernicus enables the Sea Service C4ISR development and implementation, such as the Global Command and Control System, Global

Command Support System, Defense Information Systems Network, and the Marine Air-Ground Task Force C4I (MAGTF C4I).

Implementation

Taking this vision to reality is the *Copernicus Implementation Guidance*. This *Guidance* is a coordinated Navy, Marine Corps and Deputy Assistant Secretary of the Navy (C4I/EW/Space) publication responding to the *Copernicus* vision. It includes requirements defined in the *Defense Planning Guidance* and *National Military Strategy*, among others. It is the capstone document for Navy C4ISR and MAGTF C4I and serves as a Naval C4ISR systems reference and coordinating vehicle for the integration of programs

and fielding schedules. While the intent of the *Copernicus Implementation Guidance* is to provide a general Naval approach to implementing *Copernicus*, there are, by necessity, unique requirements for Navy and Marine Corps applications which make it useful to address Service unique features in separate development and implementation concepts. They are referred to here as Navy C4ISR and MAGTF C4I.



Navy Development and Implementation

Navy seeks to establish a C4ISR baseline where systems are "born" Joint. The architecture for Navy C4ISR is being developed to Joint standards and is producing operational systems and technical architectures that embrace the objectives of C4IFTW. This open system will be implemented as current Navy systems

migrate to Joint systems.

The goal is to stop buying Service unique systems and to procure Joint capabilities.

Navy C4ISR will share tactical and administrative information using advanced networks and technologies. These new resources will continue to automate manual processes but will also improve decision support functions through advanced modeling and simulation. These networks and technologies will become part of the Navy's information architecture designed to optimize interoperability, data access, information sharing, managed security and reliability of service while reducing data redundancy and costs. This design emphasizes use of the Defense Information Infrastructure (DII) Common Operating Environment (COE). Navy C4ISR extends from the sensor to the shooter via several networks (planning, force level control, and weapons control). The goal is distributed access and processing to optimize combat power in support of Joint and Navy objectives by sharing relevant data, information and knowledge with other Services and coalition forces. When complete, Navy C4ISR will provide an integrated seamless infrastructure giving the warfighter access to the tools needed to win in any clime or place.

COPERNICUS OBJECTIVES

The *Copernicus* vision achieves C4ISR objectives outlined in *Joint Publication 6.0*. *Copernicus* highlights the Navy and Marine Corps collective interdependency on C4ISR and the intersection where Naval C4ISR must be sufficiently robust to support information exchange requirements of two Services. *Copernicus* ensures the Navy and Marine Corps maximize their synergy and take advantage of the power unleashed by the information revolution. *Copernicus* places this capability directly into the hands of the warfighter to achieve battlespace dominance.

Copernicus produces **unity of effort** by connecting warfighters at different levels of command. This brings together experience and knowledge of dispersed Joint and allied warfighters. The synergy emerging from this construct offers the Joint Task Force commander far richer options.

Copernicus provides an infrastructure that contributes to the warfighter's **total force capability** by fielding simple, responsive and easily understandable information systems. C4ISR systems should not add another layer of complexity but rather should help the warfighter better understand and manage complex operations in the battlespace.

Copernicus creates integrated capabilities that respond quickly to the warfighter's information demands. By properly **positioning critical information**, the user will be able to immediately see relevant data and have the ability to retrieve amplifying data with little or no delay.

Copernicus produces a scalable common tactical picture by **fusing multisource inputs** into a single, concise, coherent, relevant and timely display of the battlespace.

Marine Corps Development and Implementation

MAGTF C4I is the overarching concept for developing and implementing the Marine Corps common hardware, software, communications and data systems in the battlespace. It incorporates a number of systems that support the fundamental requirements of all command and control (C2)

functional areas defined in Marine Corps Doctrine Publication 6, *Command and Control*: maneuver, air operations, intelligence, fire support, combat service support and C2 Warfare. MAGTF C4I provides the warfighter the capability to store, retrieve, receive, process and disseminate essential information in a usable format throughout and external to the MAGTF. This capability will support garrison and forward deployed operations to include independent, Naval, Joint and combined operations. MAGTF C4I is the foundation for building an open system based on the DII COE. This open system will be implemented as a set of versatile, common, low-level building blocks upon which specialized hardware and software will be added to satisfy the critical operational requirements of a particular C2 functional area. The end result will provide the warfighter a C2 system with increased interoperability, reduced

development time, increased operational capability, minimal training requirements and minimized life cycle costs. MAGTF C4I provides warfighters access to the C4I tools needed to win in any clime or place.

COPERNICUS PRINCIPLES

Interoperability

Interoperability is achieved when information or services can be exchanged directly and satisfactorily between systems and warfighters. On one level, *Copernicus* provides a framework for Joint interoperability and close cooperation with other services through joint standards and common terminology, products and services. Resultant C4ISR capabilities will be interoperable and capable of free and transparent transport, translation and processing of information between and among all warfighters, regardless of environment, platform, or resource. On another level, *Copernicus* C4ISR architectures will handle horizontal and vertical information flow with equal ease. Interoperability ensures the Services will be able to exchange information without “special” operating procedures or equipment.

Flexibility

Flexibility is meeting changing situations and diversified operations with minimum disruption or delay. Modular C4ISR packages provide warfighters the ability to mold a standardized system to their specific requirements. System information services will be adaptable and scaleable, providing capabilities ranging from critical, minimum-essential to full-spectrum multimedia. The inherent design of the system provides warfighters with multiple paths achieved through fully integrated voice, data and video networks that dynamically reconfigure to connect any group of warfighters, in any operation.

Responsiveness

Responsiveness is meeting the warfighter’s demands instantaneously. To be responsive, systems must be reliable and robust. *Copernicus* is a warfighter centric vision for C4ISR responsiveness. User pull supports information requests in any environment. Warfighters will have access to critical information during key periods in military operations. This information needs to be on time and in the format requested.

Mobility

Mobility is a two-fold capability. Systems must be as mobile as the warfighters they support. The C4ISR system must be easily transportable for fixed users that must geographically relocate. Mobile users must have access to full-spectrum information services while they are on the move. The Navy-Marine Corps team must develop interoperable systems that can operate effectively throughout the world’s littorals in any clime or battlefield condition, with other Services, host nations, coalition allies and international systems. Naval C4ISR systems will allow the warfighter freedom of movement because the systems are mobile and flexible. This allows commanders to deploy the right combat mix of U.S. and allied forces on a worldwide basis.

Survivability

Survivability is maintaining key information services for command centers, weapons systems and warfighters during all phases of conflict. *Copernicus* provides the C4ISR architecture for transmitting vital information to forces in the field. These systems’ survivability will be achieved by dispersing key facilities, multiplicity of communications

modes and where appropriate, hardening to assure protected and uninterrupted information services in the presence of the enemy. It encompasses the defensive measures to protect the systems and the security of the information.

Sustainability

Sustainability is providing continuous information service during any type and length of operation. *Copernicus* highlights the Navy and Marine Corps collective interdependency on C4ISR. This occurs at multiple echelons of decision making and dispersed geographic locations. *Copernicus* integrates warfighters into the Defense Information Infrastructure so they can pull mission-critical information from their sustaining data bases. Integrated systems developed as part of the DII ensure that commanders and warfighters continue to have information services providing dominant battlespace awareness.

COPERNICUS PRINCIPLES

- Interoperability
- Flexibility
- Responsiveness
- Mobility
- Survivability
- Sustainability



WARFIGHTER'S OPERATIONAL FRAMEWORK

With the foundation of strategy, objectives and principles in mind, we now will explore the capabilities *Copernicus* brings to the Naval warfighter. The operational framework describes the actual application of the *Copernicus* architecture supporting the warfighter. This section summarizes the key operational capabilities which *Copernicus* brings to the battle: Assured Connectivity, Sensor-to-Shooter, Common Tactical Picture and Information Warfare.

Assured Connectivity

Rapid and reliable connectivity is the cornerstone of *Copernicus*. Connectivity enables the warfighter access to timely transmission of imagery, video, voice and data in peace, crisis, conflict, humanitarian support and war. Through adherence to the principle of interoperability, *Copernicus* facilitates connectivity between different Services, allies and coalition partners. While connectivity may be transparent to the warfighter, it represents the structure upon which the

remaining warfighting capabilities rest and is the enabler for dominant maneuver, precision engagement, focused logistics and full dimension protection.

Common Tactical Picture (CTP)

The warfighter's most visible link to implementation of the *Copernicus* vision will be the CTP. The CTP is "trusted" information spanning the spectrum from the sensor to the shooter to enhance understanding of the battlespace. CTP consists of intelligence, surveillance, reconnaissance, identification, environmental and positioning inputs, tactical decision aids and predictive modeling. Key factors in the CTP include location, timeliness, coverage, sensor revisit rate, accuracy and completeness. All warfighters share the same scaleable picture and can extract the pieces relevant to their specific needs, tactical situation and level of command. A CTP enables dominant maneuver, focused logistics, situational awareness and combat identification.

Sensor-to-Shooter

Copernicus improves the warfighter's capability of putting "steel on target." Sensor-to-shooter is the analytical process supporting procurement and fielding decisions for integrated systems that result in precision engagement capability. To perform precision engagement, the process includes command, surveillance and reconnaissance, acquisition and localization, combat identification, targeting, engagement and battle damage assessment. Historically, systems could only exploit specific tactical sensor capabilities to engage a specific threat. This made it difficult for different platforms, other Services and allies to share time-sensitive information. This often excluded national assets. *Copernicus* provides a capability that nets commanders, sensors and shooters in an infosphere that ensures relevant targeting data is available to perform precision engagement.

Information Operations / Information Warfare

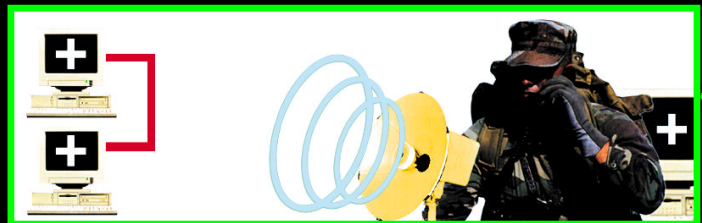
Copernicus enhances the ability of Naval warfighters to successfully conduct Information Operations (IO) and employ Information Warfare (IW). IO are actions taken to access or affect information and information systems, while defending one's own information and information systems. IW is IO conducted during a time of crisis and conflict to achieve a military objective over a specific adversary. As information gradually displaces machines and territory as an enemy's center of gravity, the importance of IO and the impact of IW on conflicts will continue to increase. IW is a required warfighting capability: the ability to exploit, corrupt, deny or destroy an adversary's information base while leveraging friendly information and information systems to achieve Dominant Battlespace Awareness. IW also provides defensive capabilities by developing and fielding secure, survivable and robust communication systems to the warfighter. As information technology continues to proliferate and as our susceptibility to Offensive IW increases, defensive IW enables full spectrum protection.

INFORMATION WARFARE

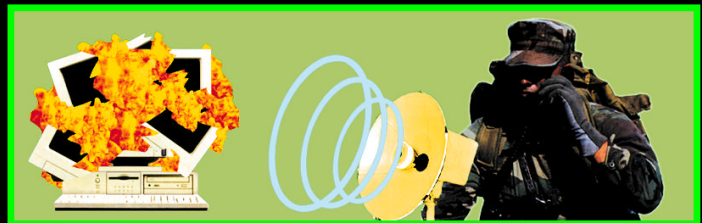
PROTECTION



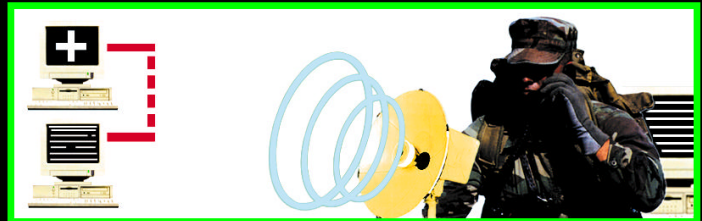
EXPLOITATION



DESTRUCTION



CORRUPTION



"If it ain't broken, break it"
Tom Peters

COPERNICUS AND THE FUTURE

The early 21st Century will witness maturing information technologies that today are in their infancy. Increased processing power, networking capabilities and software enhancements will have a dramatic and decisive impact on future warfighting, spanning the entire spectrum of conflict. The challenge facing Naval forces is to harness these forces of change. The emerging operational concept of network-centric warfare enabled by speed of command, and the co-evolution of technology, organization, and doctrine, will allow Naval forces to adapt to the new battlespace. Our Sailors and Marines are the most important part of the future technology equation and must fully exploit the potential of 21st Century information technology to wage network-centric war.

Speed of Command

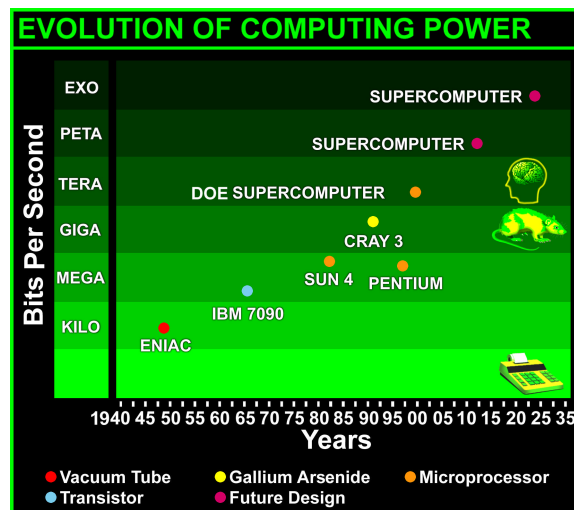
In concrete terms, network-centric warfare relies on a seamless network of sensors, shooters and commanders. True seamlessness means horizontal and vertical integration of components. The network enables speed of command. Speed of command flattens the hierarchy, frees the information systems from command systems, puts decision makers in parallel with shooters and transforms command from a step function to a continuous process. This reduces the operational pause associated with decision making and eliminates an enemy's opportunity to regain the initiative. Speed of command rapidly seizes opportunities, changes initial conditions, precisely alters early events, and locks out enemy options. Speed of command applies effort on a high speed continuum vice incremental step function, developing powerful self-fulfilling expectations for victory which demoralizes the enemy while increasing coalition and domestic support. It is characterized by extraordinary high rates of change locking out enemy solutions while locking in our success.

Co-evolution

This demands a change in our business process. Today, organization and doctrine are decoupled from and lag behind progress in systems technology. The solution is co-evolution – the simultaneous integration of systems, organization, and doctrine. The co-evolution process includes Service experiments and Fleet exercises supporting a Joint experimentation process; a Chief Information Officer providing standards for technical and operational interoperability; and enterprise-wide technology assimilation and exploitation. More than a top-down process, co-evolution is a bottom-up phenomenon built on an ethos of experimentation, innovation, and inquisitiveness. The Marine Corp's Warfighting Lab and the Maritime Battle Center are first steps in this process.

Technology

Technological challenges and opportunities facing Naval forces in the 21st Century are considerable. Three information technology areas promising the most enhancements to combat power in the future are increased processing power, more robust networking capabilities and more powerful and flexible software. In the 1990s, desktop computer power is measured in mega (millions) operations per second; in the 21st Century, processing power will be measured in giga (billions) and tera (trillions) operations per second. Computing power by the mid 21st Century will rival processing abilities of the human brain. In the 21st Century, the network will become the computer as distributed processing power generates an even greater flow of information between widely dispersed and mobile nodes. Cellular systems, modeled after personal digital assistants and cellular phones now in place, will become the norm in the future mobile computing environment. Software will become more intuitive as intelligence agents assist the user in mining distributed databases and generating



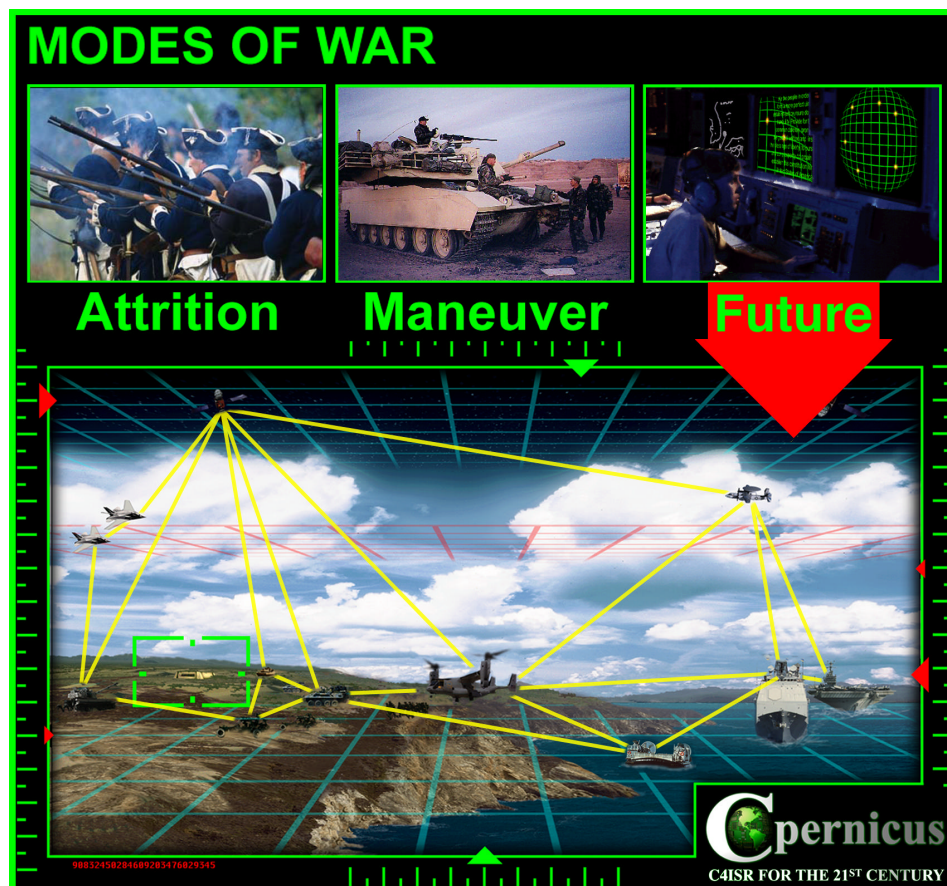
dynamic relationships in response to custom queries. As information technology advances, systems will become more adaptable and easier to use. The sum of increased processing power, mobile computing and powerful software are the technology enablers of speed of command network-centric warfare.

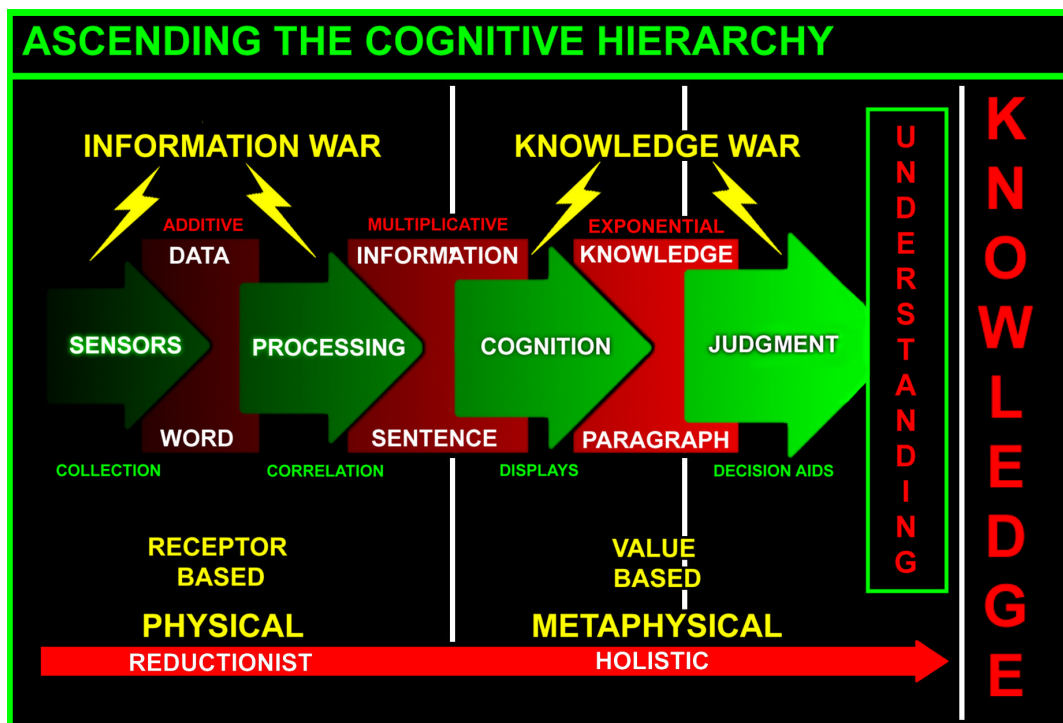
Organization

To maximize timeliness and effectiveness, information dissemination in the future battlespace requires a more direct organizational structure. With well established mission objectives, commanders and shooters will perform their missions in response to real-time sensor input and co-evolve with the battlespace. When timeliness is paramount, rapid information exchange enables decisions at lower command levels. Direct access to the Common Tactical Picture allows shooters to engage targets rapidly and exploit emerging opportunities in the battlespace. The bureaucratic organizational model of the Industrial Era that measured decision cycles in days and hours will be replaced by a networked organization where decision cycles are calculated in minutes and seconds.

As unique missions emerge in the new strategic environment, the future Joint Force must adapt and integrate combat capabilities of widely diverse units from Joint, allied and coalition forces. The diverse units forming the future Joint Task Force must communicate and fight together seamlessly. Capabilities, not systems, must be fielded to units with this principle in mind.

Education and training of these forces must keep pace and be part of a continuous process, not simply "a periodic objective." The 21st Century warfighter must "learn how to learn." The reductionist approach of mastering the parts while ignoring processes and relationships will not suffice in the complex battlespace of the future. Sailors and Marines must become intuitive learners who are mentally agile and adaptable enough to adjust to constantly changing environments, technologies, and missions. Information technology can contribute to this continuous learning process by providing remote, interactive, multimedia, training such as video tele-training and type-centered learning providing tailored education and training for Sailors and Marines.





Doctrine

The 21st Century battlespace will be dynamic and demanding of a doctrine that can adapt and evolve with new technologies and emerging threats. In accordance with increased operational tempos and new dimensions of warfare, 21st Century doctrine will emphasize nonlinear operations and speed of command where simultaneous attacks against the enemy's centers of gravity will be enabled by a robust, reliable and resilient C4ISR system.

Warfighting

As advanced technology and dramatically improved information collection and dissemination systems are fielded, the complexity and tempo of the battlespace increases substantially, leaving the warfighter bordering precipitously on the edge of chaos. The side that exploits its knowledge differential and conducts simultaneous operations against the adversary's tactical and strategic centers of gravity will emerge victorious in this environment. Derived from new science analogies concerning complex adaptive systems, *Copernicus* does not seek absolute control and understanding over this chaos, but simply attempts to drive the complexity and tempo of the battlespace beyond the C4ISR capabilities of the enemy by enabling speed of command. *Copernicus* provides the information differential allowing the warfighter to disable the enemy's decision cycle and disrupt operational momentum.

Copernicus furnishes the information services enabling Naval forces to achieve information superiority, enable *Joint Vision 2010* and conduct network-centric warfare. However, simply accumulating greater amounts of data than the enemy does not automatically equate to greater success in combat. War in the future will emphasize knowledge over information, quality over quantity. Information superiority means having greater amounts of data than your adversary. Information superiority is based on sensors, processors and communications links. Knowledge superiority means attaining a greater understanding than your enemy and exploiting this differential. Knowledge superiority emphasizes doctrine, education and training and includes the use of cognitive tools such as holographic displays, decision aids and intelligent agents to enable the warfighter.

Network-centric warfare promises to be lethal, chaotic, asymmetric and conducted in the public arena under intense media scrutiny. Understanding and addressing this increased complexity lies in our ability to harness and exploit the power of *Copernicus* and apply this power across the entire spectrum of conflict, at all levels of command.

CONCLUSION

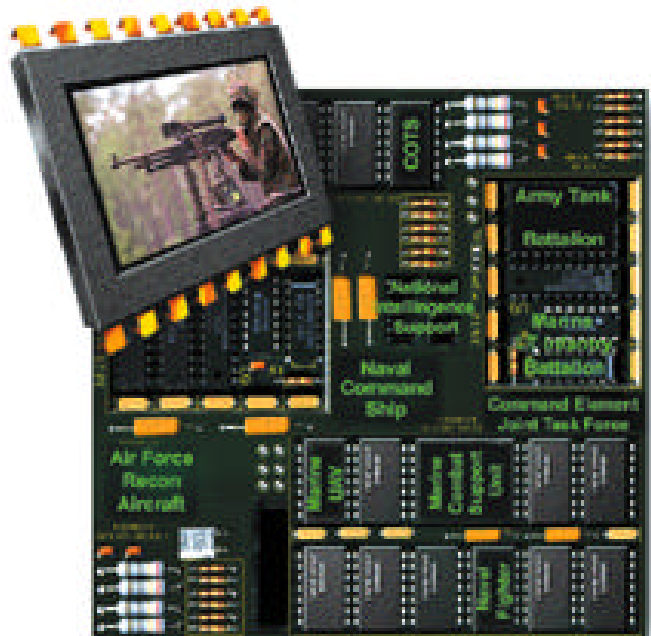


The use of information in warfare is not new. Commanders from Sun Tsu to Von Clausewitz to Schwartzkopf realized the importance of information in influencing the outcome of the battle. Information and communication have been prime drivers in the technological, social and political progression of mankind. The Information Era evolved from the intersection of information, knowledge, communications systems and information technology. In the Information Era, information and information technology are no longer considered simple enhancements to warfare. Instead, they should be viewed as military objectives, just as land, people, natural resources and capital were held in previous eras.

Changes unleashed by the information and technological explosion are affecting every aspect of the international security equation. The emergence of technology proliferation and global uncertainty as the central tenets of the new security era pose unique challenges to Naval forces of the 21st Century. *Copernicus* is the Naval response to these new challenges. It leverages the U.S. lead in information technology.

Copernicus provides the framework around which new Naval strategies are constructed that stress information, mobility and engagement. Operational Maneuver at Sea and Operational Maneuver From the Sea are Naval concepts that respond to the need for flexible and highly adaptive force packages necessary for the new world disorder. *Copernicus* provides connectivity for the widely dispersed and disparate force packages of the 21st Century. It offers a common tactical picture to the warfighter that reduces the fog of war and allows commanders to exploit their information advantage. *Copernicus* provides the technical infrastructure that enables the sensor-to-shooter process, critical to precision engagement. Information Warfare offers the warfighter a new set of tools to engage enemy forces in the newest dimension of warfare - the infosphere.

Copernicus is the enabler that allows the Navy-Marine Corps team to implement the elements of *Joint Vision 2010* which is based on achieving and maintaining information superiority. *Copernicus* provides the information technology to accomplish dominant maneuver, precision engagement, full-dimensional protection and focused logistics and allows for creation of adaptive force packaging and more coherent Joint, allied and coalition forces. *Copernicus* leverages C4ISR capabilities to equip the Navy-Marine Corps team to be prepared to meet the challenges of the 21st Century.





For More Information Contact:

Chief of Naval Operations (OPNAV)

Space - Command and Control - Information Warfare

Strategic Planning Office (N6C)

2000 Navy-Pentagon

Washington, D.C. 20350-2000

Phone: 703-601-1297

(DSN): 329-1297

Fax: 703-601-1353

<http://copernicus.hq.navy.mil>



For More Information Contact:

Commandant of the Marine Corps

Assistant Chief of Staff C4I (CS)

Headquarters U.S. Marine Corps

2 Navy Annex

Washington, D.C. 20380-1775

Phone: 703-614-3080

(DSN): 224-3080

Fax: 703-697-5786

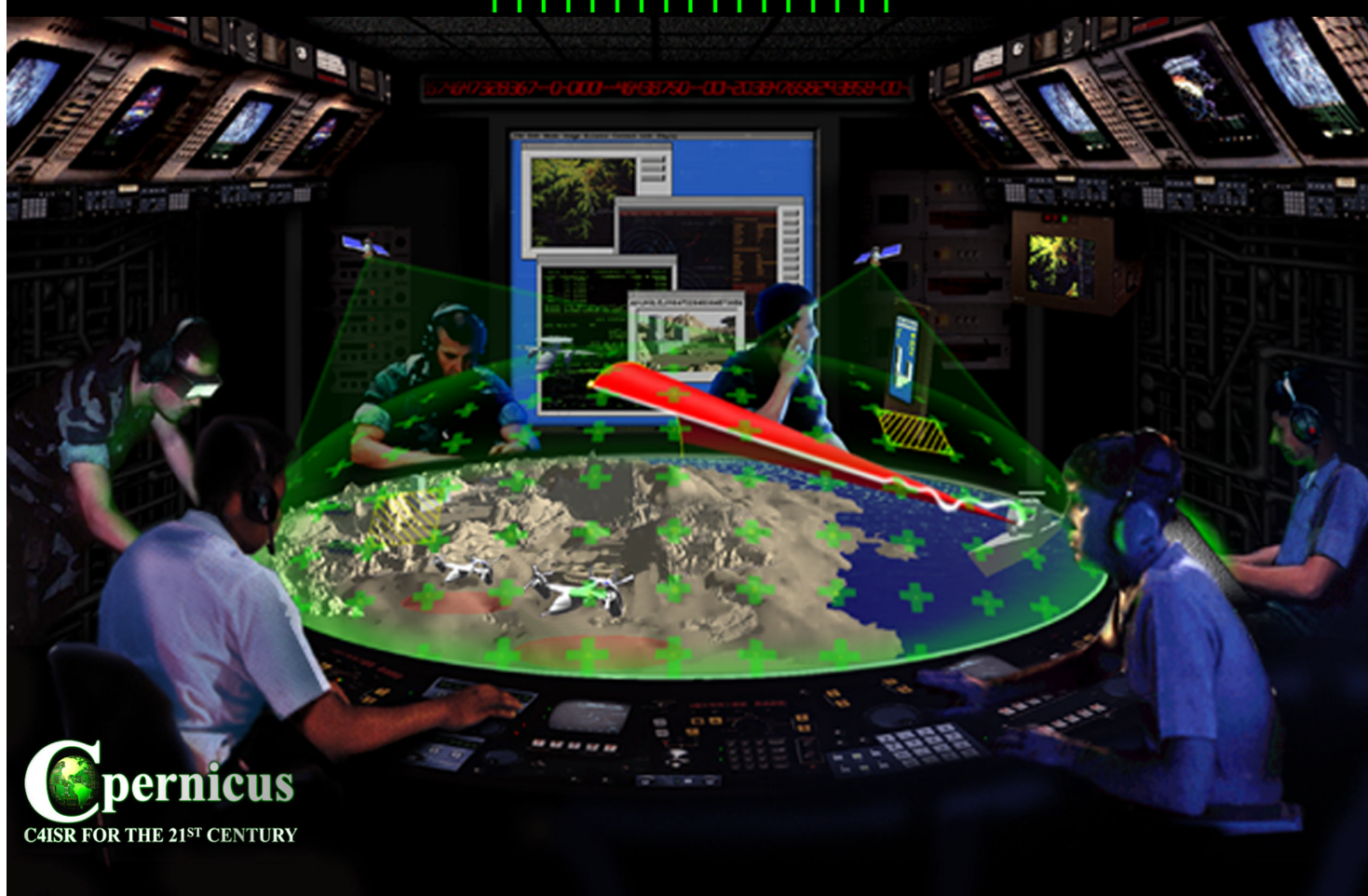
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